

## Accelerator Systems Division Highlights Ending August 6, 2004

### ASD/LANL: Warm Linac

#### DTL

1. The pad has been built to accept the beam stop for the next commissioning phase. The design is complete and parts are being made for the installation. This photo is of the pad upon which the stop will sit.



#### DTLs

#### CCL

1. CCL power supply testing is in progress and will be complete next week. A cooling system failure during the testing resulted in a magnet short which has been repaired.



**CCL-4 Magnet Power Supply Testing**

2. A magnet polarity test was completed today on CCL magnet 1-3. This test confirmed the procedure that will be used to check all 48 magnets, which will be done next Friday.



**CCL Magnet Polarity Test**

#### **ASD/JLAB: Cold Linac**

- Three cavities have been qualified for the H-8 string. Fundamental Power Couplers and HOM probes are expected to be available to support string assembly during the week of August 16.
- Assembly of the H-7 cryomodule is proceeding.
- Assembly of the H-6 string is on or somewhat ahead of schedule.

- The H-1 cryomodule has been cooled down for resumption of testing. Failures of piezo units have been associated with a poorly designed end cap, which pulls out of the assembly during cooldown (inadequate, loosely fitting threads), resulting in destruction of the piezo stack. The welded arrangement being tested now should have ample strength; its effectiveness should be known early next week.

## **ASD/BNL:HEBT, Ring, RTBT**

### **ORNL activities for the week ending August 6, 2004:**

An estimate of the beam pipe and magnet heating at the end of the RTBT beam line due to radiation indicate that no additional cooling will be required for these structures. Also, an estimate of the air activation at the end of the RTBT suggests that the levels may be low enough that no additional air handling measures will be necessary. Both these estimates are very rough. More accurate model calculations will be performed in a couple months.

### **BNL activities for the week ending August 6, 2004:**

Jie Wei and Kerri Mirabella conducted an internal review of BA remaining for FY04. Looking at accumulated costs through July, projections based on "work as usual" suggest a potential overrun by the end of the fiscal year. Accordingly, we've adjusted our spending plans for the month of August as follows:

- (1) Fabrications such as lifting fixtures, magnet support stands and outer shielding for the primary and RTBT collimators are on hold.
- (2) New, large procurements will be reviewed on a case by case basis. New work for the Shops can only be processed as "estimate only". Actual approval will be given on a case by case basis.
- (3) Credit cards and store purchases can continue with group leader approval.
- (4) Shipments to ORNL will proceed at a reduced pace. Priority will be given to RF straight section equipment.
- (5) Travel authorization will be granted on a case by case basis.

Budget, spending and year-end projections will be reviewed again in early September.

Half-cell #32 (our last half-cell) was shipped to Oak Ridge this week. Seven (7) 45 degree ion pump adaptors (one is already down at SNS) were included in the shipment.

A revised delivery schedule for Ring straight section equipment, an integral part of the Diagnostics' Production Plan, was sent to ASD's Mike Hechler for review and integration with his work plans.

RF#3 (cavity and PA) along with miscellaneous equipment for RF#2 are being prepared for shipment to SNS/OR. Our plan is to ship RF#4 by late September.

Joe Tuozzolo and Jim Rank are negotiating with Alpha Magnetics, Pioneer Steel, Elwood City Forge, and Bay Cast to obtain the last two needed pieces of yoke steel for the Extraction Lambertson Septum magnet. Alpha Magnetics is our prime contractor for this procurement.

We have been advised by our Contracts Dept. that a contract has been placed with Fiber Materials (New England) for rigidized carbon foils to be used in the HEBT line. Delivery is 10 weeks.

## **Controls**

Checkout of PPS systems continued in preparation for both DTL/CCL commissioning and cooldown of cryomodules. Linac ODH drawings have been revised to reflect "as-built" installation. Linac integration testing was finished. (Certification testing is scheduled for next week). Revisions to Chipmunk test procedures for the Target were started.

CCL4 vacuum and RCCS control system checkout continued.

Testing of the SCL vacuum control system for cryomodule #3 has started.

LLRF IOC software was updated to take advantage of recently-added timing system features. Three more SCL LLRF IOCs were brought on-line.

LANL is preparing a clean version of EPICS version 3.14.6 vacuum software. They are also working on sector gate valve control software implementation.

New features were added to power supply control software, such as: PV name changes, PLC heartbeats and ABS field. Martin Pieck was on site this week to install and test the power supply software.

LANL continued to support applications software development. ArchiveViewer was updated to JFreeChart 0.20; implementation of zoom features on logarithmic axes was started.

LANL continued RGA interface software development. The RGA software was compiled and built on EPICS version 3.14.6. A test stand has now been set up to support RGA testing.

The cable designs for Foils and Scrapers and Collimator Cooling Water Skids were upgraded to incorporate the latest requirements for spare cables and to fix mistakes.

We are starting to look at work plans for FY05. We made a first cut at dividing our BA allocation for FY05 in preparation for generating FY05 funding packages.

## **Installation**

Water Systems Installation activities:

- The De-Ox bottles are now operational on all the DTL and CCL DI systems, and monitoring has started.
- Installation of the DI piping to the RF equipment to the second set of SCL-ME6 klystrons continued.
- Installation of the DI piping to the first SCL-ME7 TRCC cart was started.
- Flow balancing of cooling to all the CCL4 magnets was completed.
- Installation of the SCL QMCS header continued.
- The RFTF clean room DI system was turned over for operation.
- Modification to the CHL compressor piping continues.
- Water maintenance activities performed this week included cleaning of chilled water system strainers and replacement of DI pump lubricants.

Ring Systems Installation activities:

- The last RING Half-Cell, #32, was received and staged for installation.
- The RING "C" arc was leak tested and a leak discovered in the Qtr-Cell chamber.
- The RING "D" arc vacuum leak testing was started.
- A shipment of Ring arc Ion Pump mounts was received.
- The installation of vacuum and diagnostic cables into the HEBT tunnel continued.

## **Accelerator Physics**

Applications programming is preparing for the next commissioning run. Two new cavity phase and amplitude setting procedures will be available. One is a signature matching method and the other is a Delta-T method. The latter application is being prepared at INR, using model input prepared by the AP group.

Another new application will be a BPM viewer, which will provide waveform caching capability for jitter analysis.

## **Operations**

Developed and presented a maze alternative to the double-wall CCL Beam stop enclosure for CCL commissioning. His design removed the need for watch-standers on either side of the wall, ODH mitigation, modification of the ASD and an Unreviewed Safety Issue. The Radiation Design Working Group meeting last Thursday to examine final details of the maze calculation.

Operations staffed the Control Room during the day shift.

### **Scheduling for the SCL**

Maintaining the Detailed schedule

Statused the high level schedule for CHL Turn-on, Transfer line cool-down and SCL RF processing including reviews, ODH installation /certification etc.

### **Preparing for the ARR**

Video Conference presentations are on Thursday August 19

On site visit and report writing Tuesday-Thursday August 24-26 with a close out

On Thursday from 11:00-12:00

Must present information on Cryo Hazard and Safety for the DTL-CCL enclosure

Gathered Maintenance plans and records. Working on the Datastream implementation.

Working with Controls and CF on issues related to control and monitoring of CF equipment and SNS utility use from the Control Room.

## **Ion Source**

Since 7/29/04 we operate ion source number 2, in which the cesium collar was slightly moved forward. It was slowly conditioned, and marginally cesiated at 480 C for 10 minutes. Currently it is operated with the air heater off, so that the 50 kW RF heat the cesium collar to a low temperature of ~ 70 C. After the solid state RF amplifier was reset Monday morning, the output current holds very close to 30 mA.

We have measured all relevant dimensions for the LBNL emittance scanner and determined the conversion constant to be 7.5 V/mrad; with V being the positive and negative voltage applied to each plate. In addition we found the angular resolution to be 1 mrad, significantly smaller than the 2 mrad step size used at ORNL and the 3 mrad step size used at LBNL. Accordingly, we are in the process of increasing the slit width to 0.01" which lowers the resolution to 2 mrad, which increases the signal to noise ratio by a factor of 4.

Together with Vladimir Baturin from the Ukrainian Science Academy in Sumy, Ukraine, we have submitted a proposal to CRDF to develop an inverse magnetron source that should meet or exceed the existing requirements for SNS

## **Survey and Alignment**

## **Mechanical Group**

## Magnet Task

### Electrical Systems

Power supplies:

Except for magnet CCL4 #8, power supply and magnet integration and check out is complete for the warm Linac. Magnet CCL 4 #8 developed a short to ground when the QMCS water system shut down for unknown reasons during power supply testing. The thermal interlock on the magnet was too slow (~seconds) to prevent damage to the magnet as there is a known weak spot in the coil design that is especially sensitive to temperature excursions. This is the second magnet that failed in such a manner due to cooling flow interruption during testing. It is hoped that the software water flow interlock will add additional protection (when implemented) during operations, and that the coils will later be upgraded. The magnet has been repaired and will be tested Monday after alignment is complete.

A test of the CCL magnet polarity check procedure was performed this week to insure that we can measure both the quadrupole and steerer polarities in the CCL. As this test involves measurement of magnet polarities with exposed terminals over 50 V, a procedure and JHA to safely perform this test has been written. The test was successful and the actual measurement of all 48 magnets is planned for next week.

Four 4000A, 18V power supplies and an injection kicker power supply were installed in the Ring Service Building.

Modulators:

Modulators DTL ME1-3 and CCL ME1-3 ran successfully in support of warm section rf cavity conditioning. The RFTF modulator continues to run in support of SCL coupler tests.

Modulator SCL ME3 assembly is complete and awaits installation (projected for next week).

## HPRF

### ORNL HIGH-POWER RF (WBS 1.4.1.1)

MEBT: Interlock problem resolved on Amplifier 4. All four amplifiers are ready for Ops.

DTL: Ready for OPS.

CCL: CCL 4 Prepped for phase shift measurements.  
CCL 1-3 Ready for OPS.

SCL: SCL ME1; several klystrons exhibited excessive reflected power indications.  
Characterized cable and coupler losses again and are re-measuring.

SCL ME2: Checked out HVCM, EPICS & Low Level interfaces, ready to test at high power next week.

RFTF: Continued cryo-coupler processing.

Misc: Our summer students made a presentation to the RF Group on the progress of their work. Jeremy Huber described his measurement of the klystron input to output phase shift with respect to power and the test chassis he built to make the measurement. Alfred Wechselberger described his work on a waveguide ferrite phase shifter and the associated theory.

**LANL HIGH-POWER RF (WBS 1.4.1.1)**

- We received permission to restart Level-1 activities with an expanded definition that includes low-voltage electrical work and mechanical assembly with power tools. We have arranged with Ray Fuja to send two people to SNS beginning August 16 for low-hazard work.
- High-power testing will be delayed until we get approval for Level-2 activities. Items we still need to test include a 550-kW klystron that did not pass our initial site acceptance test and that is now at Thales for repair. This is the last 550-kW klystron we need to test. We also need to complete 60 hours of high-power testing of the last 5-MW klystron.
- We are working on SNS documentation, including the HPRF test reports and drawing packages for the HVCM.

**LLRF**

Operations: We supported RF conditioning of the MEBT, RFQ, DTL and CCL cavities in preparation for the upcoming beam commissioning run. This activity concluded last weekend.

Installation: All LLRF VXI crates are fully populated and in operation in SCL ME1 and ME2. The MB3 cryomodule Helix cables are being terminated in the tunnel this week. The remaining activities on ME1 and ME2 include tunnel cable terminations and measurement of the corresponding cable losses, and check out and sign off on each of the RF control systems. We have populated racks in SCL ME3 and are awaiting cable pulls and AC rack power. FCM assembly and testing is ongoing in the LLRF Lab.

Procurements: HPM and FCM production procurements are 97% complete. The only outstanding items are an additional 20 Digital Front End daughter cards. We recently discovered a shortfall in the quantity of 3/8 inch Helix cable required to complete the SCL installation. The additional unplanned cable purchases will be funded out of the LLRF budget. Several pieces of test equipment are being procured to finish out the 2<sup>nd</sup> FCM test stand and to build a Ring LLRF test stand.

Ring RF: Chip Piller spent last week at BNL working with Kevin Smith on the Ring LLRF system.

**Cryo-Group****Beam Diagnostics****ORNL DIAGNOSTICS****BPM:**

Wim finished the software update and Dave has loaded this latest version of the code. Craig and the RF techs finished the remaining cables. Testing will be completed next week with the assistance of John Power.

The RF distribution chassis have been installed and tested with the fiber distribution infrastructure. Although some of the signals are a few dB lower than expected, all will be adequate for the upcoming commissioning run. This part of the infrastructure for the BPM system is now complete.

**BCM:**

BCM system is ready for the final software and calibration. This initial testing is planned for early next week.

**D-Box:**

Wim worked on the D-box emittance scanner and cloned the template, and setup a sequence execution to support responsiveness to local and remote commands and enable updates during a scan.

Madhan tested the ICS-645 digitizer to be used in the D-Box emittance scanner. After a lot of hard work by Syd, Jim Diamond and the Mechanical group, all actuators have been prepared and are now installed.

Syd has completed the D-Box Rack upgrade for the harps.

**Wire Scanners:**

Electronics are ready to support testing of the actuators. Solution to the wire holder is at hand. Randy is making excellent progress in getting them ready. Bill tests every repaired WS by running the actuators at least 10 to 20 times prior to the installation. We expect to finish the wire scanner installation by Aug-20th. The wire scanners for DTL1 and 2 are ready for installation. Paul Gibson and Gary are in the loop and have agreed with our installation schedule. Tom Roseberry is keeping track of the 30 micron carbon wire coated with different thicknesses of copper. He will assess the solution by Randy and Bill for the HEBT, Ring and RTBT wire scanner redesign. We will put out a summary report after all wire scanners are installed.

**Faraday Cups:**

All components are in and the first 3 repaired units are ready for final leak checking. Faraday Cup installation will begin on Tuesday Aug. 10th.

**BLM:**

Ion chambers and Neutron detectors are essentially ready. Andrei is cleaning up a few items related to one non-functioning channel and the interface to MPS. Coles helped with noise measurements and found that 60Hz and harmonics are entering the system. Victor will now help with the EM noise investigation. Andrei prepared Labview software for the Thermal and Si- neutron detectors. Vladimir and Andrei are testing the electronics.

**BSM:**

All BSMs are installed in the tunnel. Victor is here to work on the electronics.

**Configuration:**

Dave has been imaging the 80 IOCs required for this run. About one third have now received initial configuration in preparation for system testing. Syd reworked the server rack and installed the UPS so that we are now ready for high availability operations.

**Timing:**

The Timing PCs are installed and powered and some are already on the network. The four channel card has been demonstrated to function adequately for this run. There are still some subtle timing issues in the gate array code and Jim Pogge will address these as time permits. Cary Long (our newest subcontractor) used the National Instruments tools to develop a driver and a Labview library for these cards. This was then added to Madhan's software to provide complete integration with the EPICS control system. A vertical integration test was then performed in the Klystron gallery over the weekend. The LLRF team helped by installing the fine pitch surface-mount components on the first short run of 4 cards. The rest of the cards (over 20) were assembled and delivered this week by IES Gray. We also received all required patch cables for the fanouts.

**Racks, Cabling:**

Jim Diamond and Andy have been working on Klystron gallery racks and have made good progress. All CCL racks are now powered from their final power configuration and we only lack DTL row 2 from being complete in the DTL. They have been cleaning up some final work in CCL ( collision avoidance cables for DTL Row 7, RF Distribution in DTL Row 7, BCM Installation in DTL Row 6, and A/C power install in DTL Row 2), prior to moving on to SCL. In SCL Row 1 there is a complete rack install of WS00 and BCM00 with power, network and long haul cable termination.. The DB crew has been working on the following: termination of CCL4 remaining cables, finding the transition area cables for temporary use, re terminating the NDt cables in the tunnel, and they also pulled a temp beam stop signal coax cable to CCL Row 8 Cab 2 (B8300:08C02-31). The Temporary Beam Stop will reside

**LANL DIAGNOSTICS (WBS 1.4.5.2)**



- *RTBT Harp Electronics:* We are having three electronics chassis wired, with a projected delivery time in two weeks. We also began production of the 16-channel integrator boards, with 12 boards to be delivered in two weeks.
- *RTBT Harp Pickup:* We have received all of the ceramic cards from the vendor. One harp is completely assembled, and the second unit should be ready in two weeks. We expect to complete the hardware in early September with all units shipped to ORNL.
- John Power is scheduled to be at ORNL August 11-25 to work on diagnostics within the Level-1 approval envelope.